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NO. 62200
ELECTRO-CHEMOGRAPH
RECORDING ASSEMBLY

LEEDS NORTHRUP
PHILADELPHIA 44, PA.

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NO. 62200

ELECTRO-CHEMOGRAPH RECORDING ASSEMBLY

1. GENERAL DESCRIPTION

A. Introduction

The No. 62200 Electro-Chemograph provides a means for chemical analysis of a great number of dissolved, reducible or oxidizable substances. The method consists of electrolysis of the solution in a cell having a small easily polarized electrode and a large non-polarizable electrode. Electrolysis is brought about by applying a steadily increasing or decreasing polarizing voltage to the cell. The resulting current, detected by means of a null-balance current-measuring system, is recorded on a microampere recorder and the record may be analyzed to yield data permitting quantitative estimation and qualitative identification of the materials present in the solution.

The null-balance current-measuring system applied to the dropping-mercury electrode is illustrated in diagram below. While a drop is suspended at the end of the capillary tube, a polarographic diffusion current,

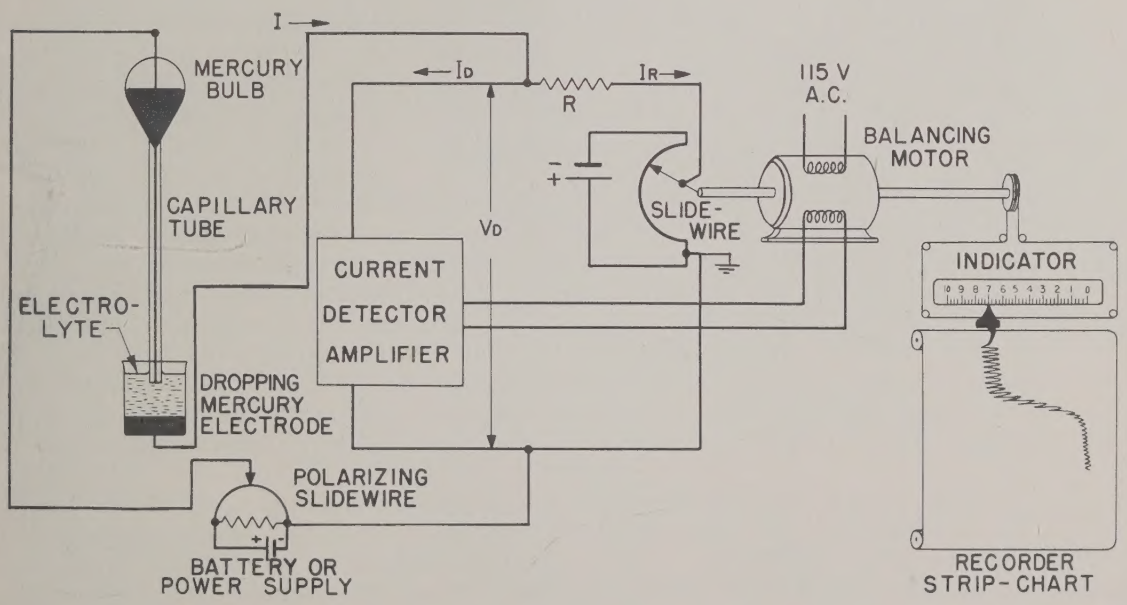

Fig. 1
The Speedomax Electrical Balancing System for measuring diffusion current.

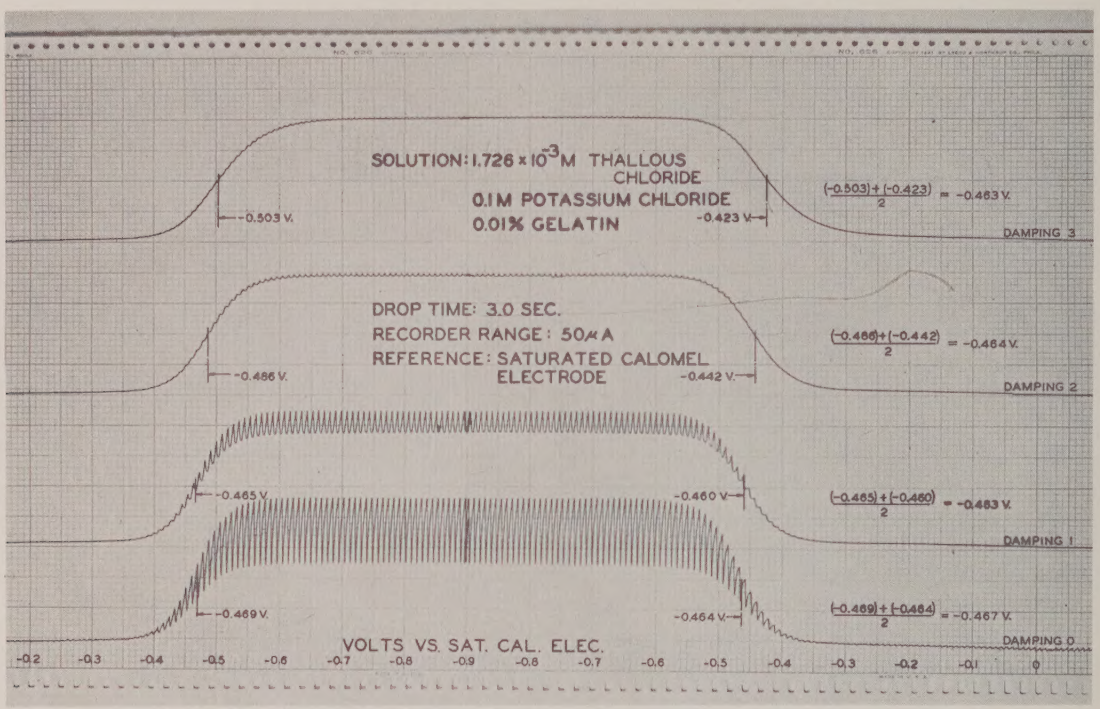

Fig. 2
Reverse-polarization method for averaging half-wave potentials.

which occurs as a result of the depolarizing action of the reacting substance at the dropping-mercury electrode, is passed into the current-measuring network.

The current I divides between the detector network and the current range resistor R, producing a voltage drop V_D across the detector branch. The voltage V_D is amplified and impressed upon one winding of the two-phase balancing motor, which advances the slidewire until I_R equals I, leaving no current flowing in the detector, and therefore no more voltage to drive the motor. The system remains at balance until a further change in I occurs, again causing an unbalance voltage, a compensating motion of the motor repositioning the slidewire arm, and restoring balance, all occuring simultaneously to keep the pen and pointer correctly positioned.

Current ranges are determined by network made up entirely of precise, factory-calibrated resistance elements. Further accuracy is assured by use of a standard cell for standardization. Capacitance-resistance networks determine three degrees of recorder damping, while an undamped position is also available. Selection is made by means of the panel-mounted switch.

In the determination of half-wave potentials from records of tests

using various degrees of damping, apparent half-wave potentials vary with the damping. The first damping position on the Electro-Chemograph, Type E, yields half-wave potential values in agreement with accepted literature values. It is also most significant, and characteristic of this particular instrument, that because of the use of the null-balance method of measuring current, the microampere recorder introduces negligible error into potential readings.

Fig. 2 illustrates a method for determining half-wave values precisely, affording excellent results for each damping position. By reversing direction of polarization at completion of a run, a reverse step can be produced. By averaging the two values of half-wave potential thus recorded, a highly precise value is obtained regardless of damping used. This can be verified by making a complete reverse-polarization curve for each degree, and comparing averaged values.

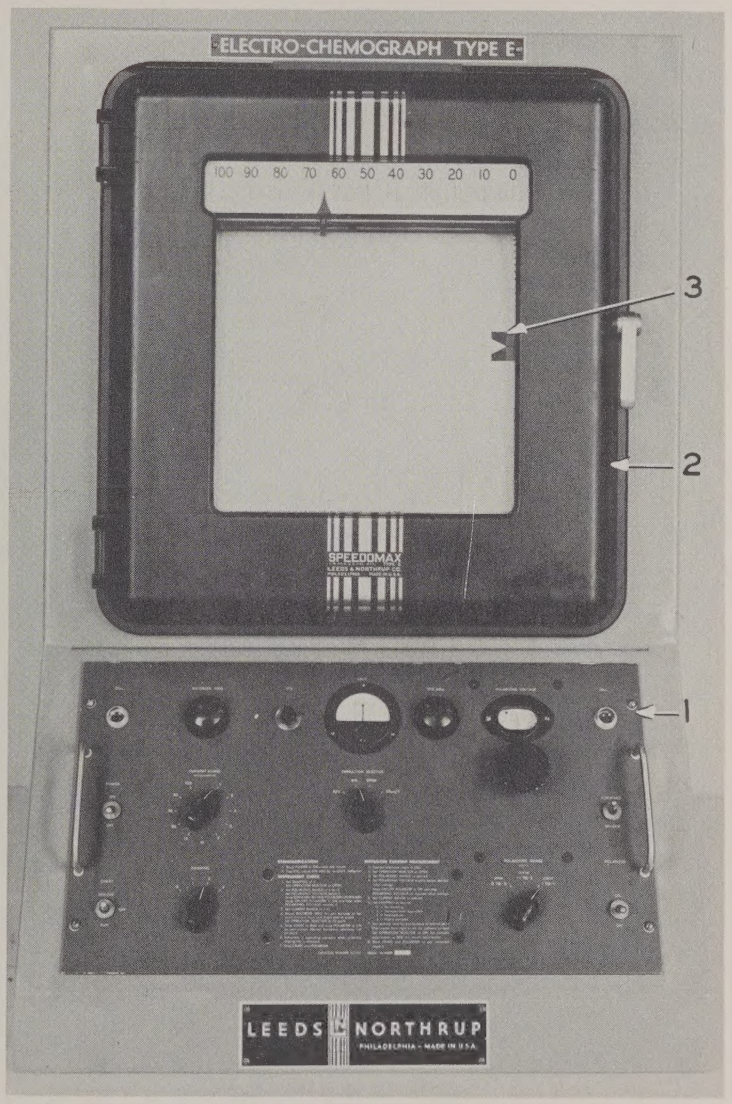

Fig. 3

B. Equipment

The No. 62200 instrument consists of a control panel 1, Fig. 3, mounted beneath a microampere recorder 2, Fig. 3, in a console-type cabinet. The panel and recorder contain the polarizing circuit and measuring circuit.

The No. 62200 instrument does not include a d-c power supply. How-

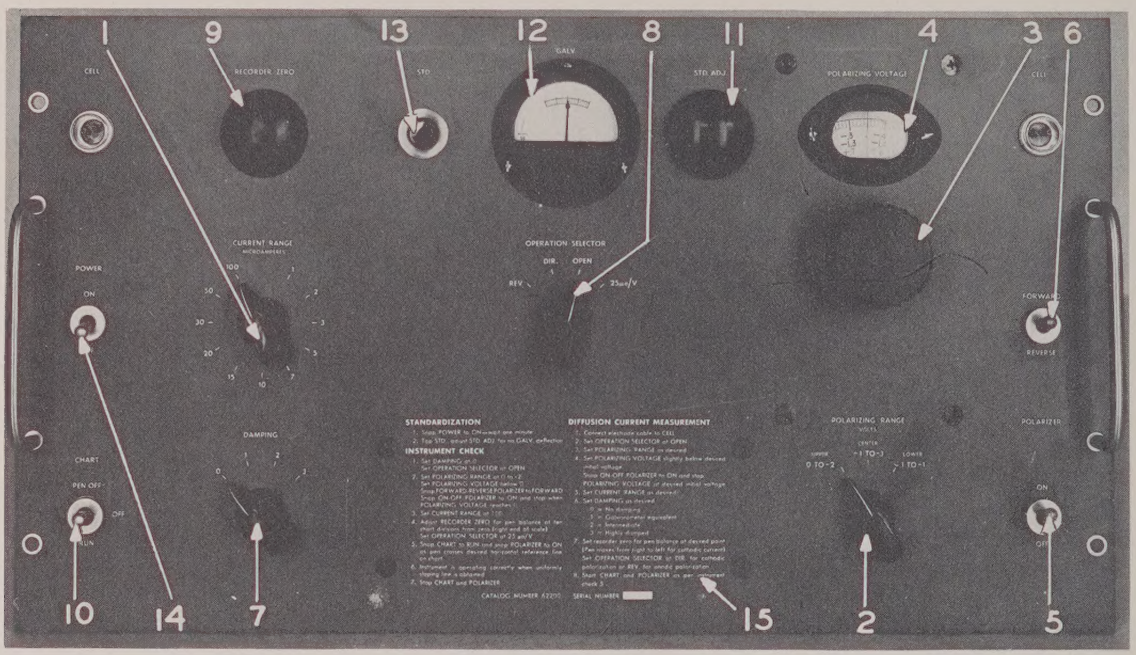

Fig. 4

ever, it is suggested that the Leeds & Northrup a-c operated Power Supply Unit be used. This unit operates from a 115 volt a-c power source and furnishes a regulated d-c supply for the instrument. This unit is shown mounted in place in Fig. 5. On the other hand, two 6 volt, low discharge, 100 ampere-hour batteries (L&N No. 7596 "Willard") in series, may be used in place of the power supply unit. A special cable is furnished with the No 62200 for making the connections between the battery and the instrument. An 069074 battery mounting plate will be needed.

The polarizing cell necessary to complete the installation may be of various arrangements. The Leeds & Northrup No. 7732 Polarotron or No. 7733 Dropping-Mercury Electrode Assembly are quite suitable. Other forms of electrode equipment in general use for polarographic analyses can be readily used with the No. 62200 Electro-Chemograph.

An auxiliary polarizing unit, No. 7739, providing slower rates of polarization than the unit supplied in the No. 62200 Electro-Chemograph, is available and can be attached to the Electro-Chemograph simply by plugging the cable from the No. 7739 Auxiliary Polarizing Unit into the octal socket from which the plug 10, Fig. 5, has been removed.

2. INSTALLATION

It is suggested that the recording assembly be placed on a sturdy table large enough to permit the polarizing cell to be located adjacent to it without undue crowding of the equipment. Sufficient space should be allowed

around the equipment for convenient inspection and maintenance.

Although the recorder will operate satisfactorily in a location where vibration is encountered, the polarizing cell should be mounted in such a manner as to be free from vibrations.

When the a-c operated power supply unit is used, it should be mounted as shown in Fig. 5. There are two tapped holes in each end of the chassis to be used for fastening the support block as shown in Fig. 5.

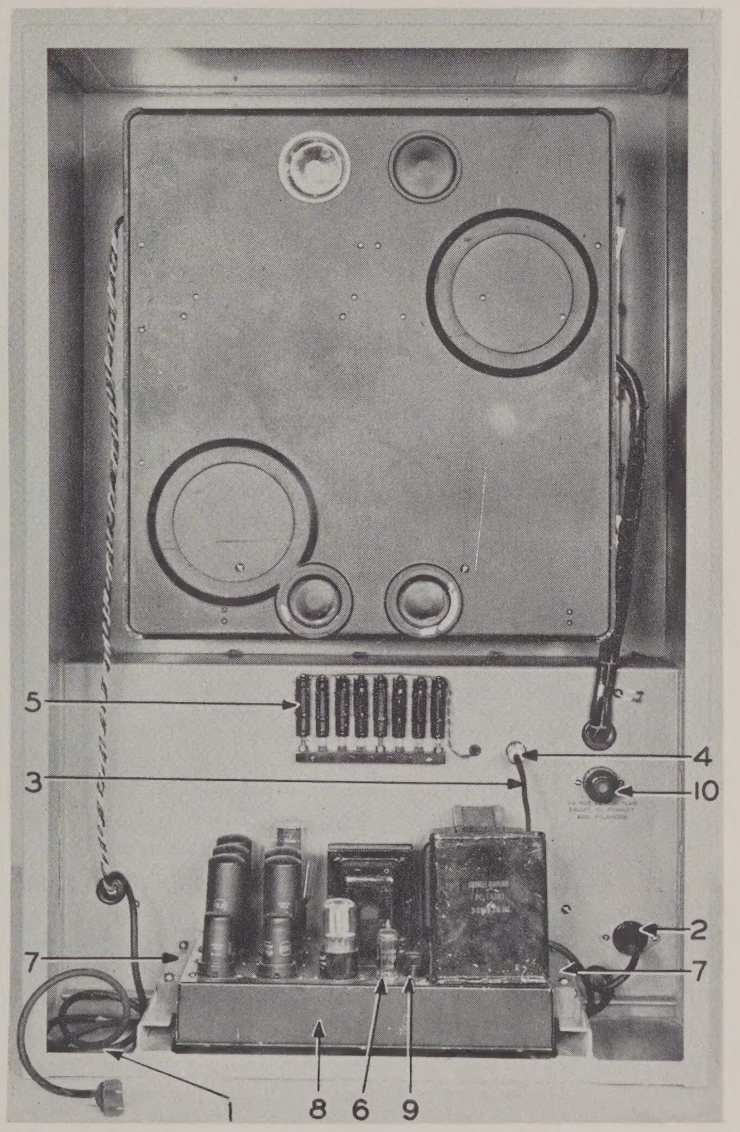

Fig. 5

Remove the two blocks 7, Fig. 5, from the mounting supports (two screws down through the top of each block) and remove the nuts from the two bolts through the side of each block. Mount these blocks on the ends of the chassis 8, Fig. 5, by means of the bolts through the blocks threading into the tapped holes. Keep marked sides of blocks out. Slide the unit in place on the supports as in Fig. 5, and fasten it with the two screws in each block 7 (the supports are tapped for these screws).

Plug the line cord 1, Fig. 5, into a 115 volt a-c (usually 60 cycle) supply. See diagram sent with the equipment.

When the a-c operated power unit, as shown in Fig. 5, is used for the regulated d-c voltage supply, the two-pronged plug on this unit for the a-c input should be plugged into receptacle 2, Fig. 5, and the cable connector

3, Fig. 5, should be inserted in the receptacle on the power unit for the d-c output and into receptacle 4, Fig. 5.

When a 6 volt storage battery is used for the d-c voltage supply, use the special cord furnished with the Electro-Chemograph to connect the battery to the instrument. To do this, insert the connector on the cord into receptacle 4, Fig. 3, and then clamp the free ends of the special cord to the battery terminals, with polarities as indicated on the clips.

3. RECORDER

The recorder is a high speed electronic instrument which furnishes a complete record of the current, plotted against voltage applied to the polarizing cell, for each analysis.

Directions for adjusting and operating the recorder may be found in the Direction Books supplied with the instrument. With the exception of the gain control adjustment on the amplifier in the recorder, all control dials and switches are located on the control panel.

4. CONTROL PANEL

The control panel contains all the controls for operating the Electro-Chemograph, with the exception of the gain control for the amplifier in the recorder. The various elements of the control panel and their functions are discussed below.

A. Current Range (Microamperes)

For every reducible or oxidizable substance in solution, the limiting value of the current passing through the cell (known as the limiting diffusion current) and recorded by the microampere recorder will be different. Even through such variables as temperature and concentration are held constant, the diffusion current will depend on the formation and size of the electrode surface at which the reaction occurs, as well as the composition of the solution itself. Provision has been made for full scale measurement of eleven different ranges of current.

The CURRENT RANGE switch 1, Fig. 4, should be positioned to a range which will give the desired scale coverage. For example, if the current during an analysis increases by 20 microamperes, the record will extend from one end of the scale to the other when the CURRENT RANGE switch is set at 20. If, however, the switch be set at 100, the record of the same analysis will cover only one fifth of the scale.

B. Polarizing Range (Volts)

The diffusion current recorded by the recorder is obtained by applying to the polarizing cell a potential which increases at a constant rate.

Three different ranges of potential are available, each covering a two volt span.

By positioning the POLARIZING RANGE switch 2, Fig. 4, the voltage applied to the cell may be made to vary from 0 to -2 volts, -1 to -3 volts, or from +1 to -1 volts.

Intermediate voltages may be obtained by rotating the POLARIZING VOLTAGE knob manually to set the desired value, as indicated on the scale at 4, Fig. 4, under the hairline index. There is no lost motion between the knob and the slidewire setting. Any noticeable backlash is in the gearing between the motor and slidewire (see Section 5-D).

The polarity of the polarizing potential on the dropping-mercury electrode may be reversed by turning the OPERATION SELECTOR 8, Fig. 4, from DIR. to REV. This switch when set at OPEN also allows the recorder to be disconnected from the polarizing slidewire and cell so that the recorder zero may be positioned on the chart. A fourth point on this switch marked 25μa/V, puts a calibrated resistor into the polarizing circuit in place of the polarizing cell. This affords a quick check of the electrical measuring equipment as outlined in Section 5-D and on the control panel of the instrument.

The polarizing voltage is supplied by a motor driven slidewire; operation of the motor being controlled by the POLARIZER ON-OFF switch 5, Fig. 4. When the motor is running, the polarizing voltage changes at the rate of 100 millivolts per 30 seconds (2 volts in 10 minutes). Increasing or decreasing polarizing voltage is obtained by positioning the POLARIZER FORWARD-REVERSE switch 6, Fig. 4, for the desired direction of rotation of the slidewire.

The range +1 to -1 should be selected if it is desired to combine anodic or cathodic polarization in one analysis. To perform anodic or cathodic polarization alone, one of the other ranges may be selected, the substance to be analyzed determining which one.

C. Damping

The current passing through the cell is, in part, dependent for its value on the characteristics of the mercury drop forming the polarizable electrode, as previously mentioned. As the mercury drop grows, the current will increase to a maximum value and as the drop falls from the electrode, the current will decrease to a lower value. A very sensitive, undamped, measuring circuit will pick up every value of this oscillation and produce a wide record on the chart. To produce a smoother record, damping is introduced into the measuring circuit.

Four degrees of damping are provided. The degree of damping selected affects the recorded diffusion current as determined by the mean

of the recorder oscillations and the recorded half-wave potential. By means of the DAMPING selector switch 7, Fig. 4, the desired recorder time constant may be selected for various types of polarographic measurements. Increasing the degree of damping (from the 0 position to position 3 on the DAMPING selector switch) decreases the magnitude of the recorded current oscillations. The damping selected for a given application will depend upon a compromise between a smoother current record or a more precise recorded half-wave potential.

D. Standardize d-c Voltage

The voltage supplied to the d-c circuits should be adjusted against the standard cell, located under the control panel, each time the equipment is put into operation. When a battery is used in place of the a-c power supply unit, it is recommended that the voltage be standardized about every thirty minutes during operation.

To standardize, adjust the STD. ADJ. knob 11, Fig. 4, until the galvanometer 12 does not deflect when the STD. button 13 is depressed. The STD. button should only be depressed momentarily to avoid damaging the galvanometer or causing deterioration of the standard cell.

The galvanometer pointer may be set to zero by turning the screw adjustor below the galvanometer scale.

E. Recorder Zero

A continuously variable recorder zero adjustment has been provided, having a range of twice the full scale current range of the recorder regardless of the recorder current range in use. This feature is advantageous when it is desired to show several diffusion waves on the same section of chart paper or when combined anodic and cathodic waves are to be recorded. The extension of the zero adjustment in both directions also allows for some compensation of diffusion current waves.

F. Recorder Chart And Pen Control

CHART switch 10, Fig. 4, has been provided for starting and stopping the recorder chart. The pen carriage is provided with an electromagnetically operated lifting device which is arranged so that the pen is lifted from the chart when the CHART switch is in the OFF position (chart stopped) and when it is in the PEN OFF position (chart running but pen lifted from chart). The only time the pen is on the chart is when the CHART switch is in the RUN position. By having the pen off the chart when changes are being made to the various control settings, irrelevant chart markings are eliminated.

G. Power Supply

Normally, an a-c operated power supply unit is furnished for the 6

volt d-c required. This unit is mounted in the housing as shown in Fig. 5. It regulates the d-c supply at 105 volts and, by means of resistors 5, Fig. 5, supplies 6 volts d-c to the measuring circuits. The stability of the 6 volt supply, after warm up, is in the order of 0.01% for normal line voltage fluctuations.

A 6 volt storage battery, having a minimum capacity of 40 ampere-hours, may be used in place of the a-c operated power supply unit. Special leads are available for use in connecting the battery to the circuit, as outlined in Section 2.

The a-c power supply is turned ON and OFF by means of the POWER switch 14, Fig. 4. Thus, when the a-c operated power supply unit is used, the measuring circuits are deenergized when the switch is in the OFF position. However, when a battery is used for the d-c supply, it is also necessary to disconnect the battery to accomplish this.

5. OPERATION

A. General Data

Satisfactory measurement of diffusion currents can be made by following the condensed directions on the control panel. It is assumed that the operator of the equipment is familiar with the technique of making such measurements and it is felt that a good reference on the subject is "Polarography," by Kolthoff and Lingane (1941), Interscience. The data given in this Section cover the proper steps when using the Leeds & Northrup Electro-Chemograph.

B. Start The Equipment

When the a-c operated power supply unit (to supply 6 volts d-c) is used, simply snap the POWER switch, Fig. 4, to ON and wait about a minute for the electron tubes to warm up. However, when the 6 volt storage battery is used for the d-c supply (in place of the a-c operated power supply unit) it is also necessary to see that the battery is properly connected to the equipment.

C. Standardize d-c Voltage

Over a period of time, the d-c voltage supplying the measuring circuit of the recorder and the polarizing circuit, may vary a slight amount. This voltage should be standardized before starting a series of readings.

To standardize this voltage, against the standard cell located beneath the control panel, proceed as follows: First, check the galvanometer (GALV., Fig. 4) pointer to see if it is at zero on its scale. If this is not so, turn the small screw on the galvanometer case until this condition is obtained. Then press the STD. button momentarily and observe the gal-

vanometer for any deflection from zero. If the galvanometer does not deflect, the d-c voltage is properly adjusted. If the galvanometer does deflect, adjust the STD. ADJ. dial a slight amount and again press the STD. button momentarily and note the galvanometer for any deflection. Continue this alternate operation of the STD. button and the STD. ADJ. dial until the galvanometer does not deflect from zero when the STD. button is pressed and released.

Do not hold the STD. button down for an appreciable length of time as this may damage the galvanometer as well as cause deterioration of the standard cell.

D. Check Instrument (Fig. 4)

Before making measurements, the instrument should be checked to be sure the circuit is functioning properly. To do this, proceed as follows:

Set the DAMPING switch at 0. Under this condition, damping is eliminated from the measuring circuit and the response to changes in voltage will be very rapid.

Set the OPERATION SELECTOR switch at OPEN. This opens the connections between the polarizing slidewire circuit and the measuring circuit.

Set the POLARIZING RANGE switch at 0 to -2. Turn the POLARIZING VOLTAGE knob 3, Fig. 4, until the voltage, as shown on the 0 to -2 scale is below 0. Snap the POLARIZER switch 6, Fig. 4, to the FORWARD position. Snap the POLARIZER switch 5, Fig. 4, to ON and observe the movement of the POLARIZING VOLTAGE slidewire scale, stopping it (snap switch 5 to OFF) when the voltage reaches 0 on the 0 to -2 scale. This set of operations accomplishes two things. First, it positions the polarizing slidewire at 0 more accurately than can be done manually (by knob 3, Fig. 4); and second, it takes up any backlash in the gear train between the motor and the slidewire.

Set the CURRENT RANGE switch at 100.

Adjust the RECORDER ZERO dial until the recorder pen balances at the point which is ten chart divisions from 0 (right hand end of the scale).

Set the OPERATION SELECTOR switch at 25μa/V.

Snap the CHART switch to RUN. As the pen crosses a major horizontal line, (indicator 3, Fig. 3, can be used for this purpose; when a major horizontal line is in line with the notch of this indicator, the pen is at a similar line), snap POLARIZER switch 5, Fig. 4, to ON.

NOTE: Indicator 3, Fig. 3, was adjusted in the factory to function properly with the pen sent with the recorder. There may be slight mecha-

nical variations in the glass of different pens. Therefore, when a different pen is used in the recorder, check to see that the pen point is on a major line when a similar line is at the indicator. If this is not so, set the pen at a major line and then adjust the position of the indicator to match a similar line. To do this, loosen the screw in the indicator and adjust its position, then tighten the screw to hold this adjustment.

If the pen draws a uniformly sloping line, the instrument is operating correctly. If the run is started as directed above, it should finish within a quarter of a division of a line which is ten divisions past the center of the chart.

Then snap the CHART switch to OFF and POLARIZER switch 5, Fig. 4, to OFF.

E. Diffusion Current Measurements (Fig. 6)

Connect the electrode to either of the CELL receptacles on the control panel. A special shielded cable is made by Leeds & Northrup for this purpose. Insert the plug, on one end of this cable in either CELL receptacle. The other end of the cable consists of two separate leads, each equipped with a clip. Connect the lead marked MERCURY to the mercury reservoir of the polarizing cell (or other polarized electrode) and connect the lead marked REFERENCE to the reference electrode of the cell.

Set the OPERATION SELECTOR switch at OPEN.

Set the POLARIZING RANGE switch at the desired range.

Set the POLARIZING VOLTAGE manually until the index is at a value (on the selected range) which is slightly below the desired initial voltage. Then set the POLARIZER switch 5, Fig. 4, to ON. When the POLARIZER VOLTAGE reaches the desired initial voltage, snap switch 5 to OFF.

Set the CURRENT range switch to the desired range.

Set the DAMPING switch at the desired point. With this switch in the 0 position, there is no damping; in the 1 position, galvanometer equivalent; in the 2 position, intermediate damping; in the 3 position, highly damped.

Adjust the RECORDER ZERO dial until the pen is at the desired line for the start of the curve (the desired zero point). Keep in mind that the pen moves from right to left for cathodic current and in the reverse direction for anodic current.

Set the OPERATION SELECTOR switch at the proper position; at DIR. for cathodic polarization and at REV. for anodic polarization.

Snap the CHART switch to RUN and POLARIZER switch 5, Fig. 4, to

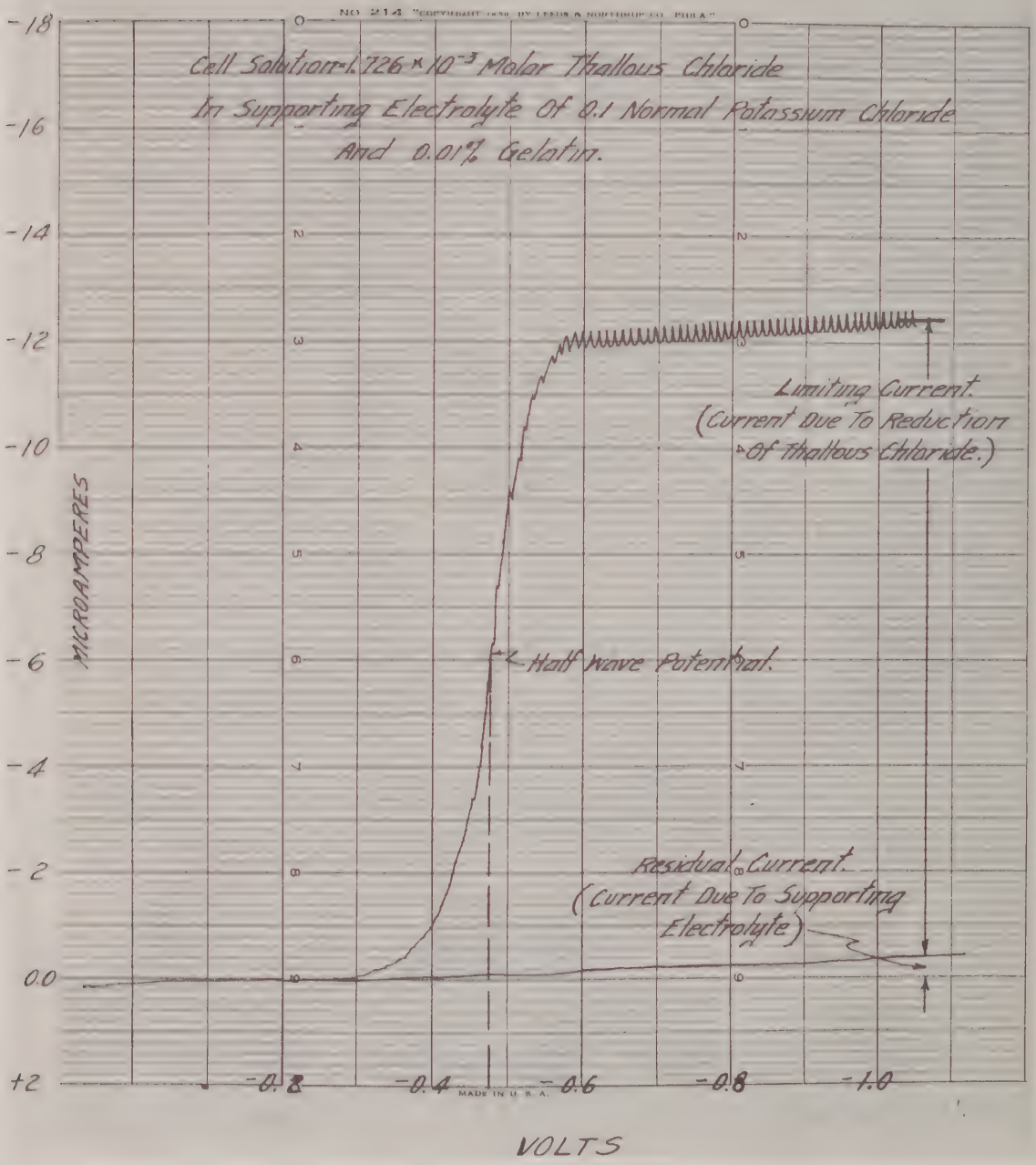

Fig. 6

ON as the pen crosses the desired horizontal reference line (when a similar line is in line with the notch of indicator 3, Fig. 3).

After the curve is run, snap the CHART switch and POLARIZER switch 5, Fig. 4, to OFF.

F. Half-Wave Potential Measurements (Fig. 6)

One way to determine the half-wave potential is, of course, to obtain the point on the chart which is half way between the initial current and the limiting current. Then read the voltage on the chart which corresponds to this point. However, the damping used for the curve will affect the accuracy of the reading obtained by this method.

A somewhat more precise method of determining the half-wave potential is to obtain the point on the chart which is half way between the initial current and the limiting current. Then rotate the POLARIZING VOLTAGE dial 3, Fig. 4, manually until the recorder pen is at this half way mark. The half-wave potential may then be read on the POLARIZING VOLTAGE scale 4, Fig. 4 (reading the scale for the voltage used for the diffusion current curve being analyzed).

The most precise method of determining the half-wave potential is as follows: With the DAMPING switch in either the 2 or 3 position, make a current voltage curve in the normal manner and then continue the curve, in reverse, by reversing the direction of rotation of the POLARIZING VOLTAGE slidewire. Then obtain the half-wave potential of each section of the curve (both the forward section and the reverse section), and take the mean of the sum of these two values for the half-wave potential. The method is illustrated in Fig. 2. The two curves marked DAMPING 2 and DAMPING 3 are indicative of the type obtained when following the procedure given above.

6. MAINTENANCE

A. Recorder

The Speedomax recorder and amplifier used in the No. 62200 Electro-Chemograph Assembly has been especially designed as a high performance, low level unit. The minute signals encountered in polarographic work require the use of a slidewire and contact combination that is essentially free of thermal effects. For this reason, a smooth constantan wire and high contact pressure is used. The oscillatory nature of polarographic recordings and the high contact pressure reduces the endurance of the slidewire contact. In order to obtain maximum contact life, the following procedure is recommended:

(1) The slidewire should be lubricated at frequent intervals with a very light coating of Vaseline. All excess lubricant should be removed each time it is applied.

(2) Turn off the main power switch of the Electro-Chemograph when

the equipment is not in use for extended periods of time.

(3) Do not adjust the slidewire contact for excessive pressure.

(4) Avoid oscillation of the recorder because of an excessive amplifier gain setting.

The recommended contact pressure for the main slidewire is 24 ounces. This is the force required to lift all three leaves of the contact simultaneously. This pressure is most conveniently measured by means of a spring balance with an L shaped hook on the end. In occasional cases, where additional sensitivity is desirable, it is permissible to increase this pressure to 27 ounces with the understanding that there will be some increase in wear. More frequent lubrication is required in such cases.

In the event of evidence of wear on the contacts, they may be redressed for further use. Contact pressure should be readjusted to the proper value.

In order to avoid excessive wear at one spot on the slidewire itself, the Electro-Chemograph should not be operated continually with the zero pen position at the same spot on the scale. Since maximum slidewire wear occurs at the zero pen position, the zero pen position should be shifted up or downscale at occasional intervals. This point is mentioned because some users of the equipment habitually keep the pen at a zero position of say 5 or 10 on the instrument scale.

In order to protect the equipment from damage due to excessive currents, a number of fuses are provided. The location and function of each fuse is given in the following table.

FUSES			
TO PROTECT	LOCATION	AMP SIZE	PART NO.
Slidewire Balancing Motor	Interior of Recorder Case (top right fuse)	3	R-145-W
Pen and Chart Motor	Interior of Recorder Case (top left fuse)	3	R-145-W
Pen Lifter	Interior of Recorder Case (top center fuse)	3	R-145-W
Recorder Amplifier	Under recorder amplifier chassis	0.6* Slo-blo 1.25** Slo-blo	14-5-0-3 14-5-0-4
Power Supply Unit	See item 9, Fig. 5	1.6 Slo-blo	14-5-0-2

* 60 cycle operation
** 50 cycle operation

Refer to the separate directions for 60000 Series Speedomax Recorder for additional maintenance information.

B. Power Supply Unit

If the d-c voltage has to be standardized at too frequent intervals, the tubes of this unit should be checked and any tubes found to be weak should be replaced with new ones.

CAUTION: Before removing a tube from this unit be sure to disconnect the a-c input at 2, Fig. 5, or at 1, Fig. 5. The removal of certain tubes, while the unit is energized, will cause a high d-c voltage output as outlined in Section 4-G.

It is suggested that any new tubes 6, Fig. 5, be purchased through Leeds & Northrup Company in order to obtain a tube which has been properly checked for quality.

C. Control Panel

The POLARIZING VOLTAGE slidewire should be cleaned occasionally the same as indicated for the measuring slidewire for the recorder (as indicated in the Direction Book for the recorder).

D. Polarizing Cell

See separate data on this cell.

7. REPLACEMENT PARTS

A. RECORDER PARTS

Part No.	Description
10-1-13-24	Voltage Dropping Resistor; 102.5 ohms ±1%, on Std. 291 spool. Mounted on rear panel, 8 required for complete replacement.
R-815-BF	Slidewire
R-815-BE	Slidewire Contact
R-504-L-7665	Scale; 100 to 0, #626-BL Chart Paper (printed in blue ink)
R-503-BW	Wooden Mandrel
102-1-0-2	Pen Lifting Solenoid
19-5-0-5	Output Transformer
R-501-CL-1	Fluorescent Bulb
R-10501-CK	Fluorescent Ballast
R-501-CJ	Fluorescent Starter
R-820-51	Amplifier (Complete)
R-145-W	Fuse; 3 ampere, screw-plug type

NOTE: For other recorder parts, see Parts Catalog P-ND46(1).

B. AMPLIFIER PARTS (R-820-51)

Std. 3338-6	Converter
22-1-0-4	Electron Tube; 12SL7
Std. 3246-178	Electron Tube; 6L6
22-3-0-1	Electron Tube; 6X4
Std. 1178-43	Power Transformer
Std. 3246-166	Gain Control
57-1-0-5	Selenium Rectifier

Part No.	Description
14-5-0-3	Fuse; 0.6 ampere, for 60 cycle operation
14-5-0-4	Fuse; 1.25 ampere, for 50 cycle operation

C. CONTROL PANEL PARTS

Std. 3360-C	Panel only
#243	Direction Plate
40-3-0-10	Cell Receptacle
13-1-0-5	Recorder Zero Potentiometer; 10 turn; shunted to 10 ohms ±0.05%
21-2-0-1	Galvanometer
13-1-0-6	Standardization Adjuster; 10 turn, 100 ohms
12-3-0-5	Polarizing Voltage Slidewire; 40.0 ohms ±0.05% with 2 shunt coils (center tap) and 58-3-8-1 scale
R-501-S-5	Power Switch
31-11-0-1	Current Range Switch
32-4-0-5	Operation Selector Switch
R-501-S-6	Polarizer Forward-Reverse Switch
32-2-0-3	Chart Switch
31-11-0-2	Damping Switch
32-4-0-6	Polarizing Range Switch
R-501-S-6	Polarizer On-Off Switch
PI-127	Standard Cell
017191	Polarizing Slidewire Motor
32-1-0-3	Polarizing Slidewire Limit Switch
23-3-0-5	Damping Capacitor; 2, 12, 16, 24, 48 mfd
PI-123-N	Standardization Key
2-5-9-1	Rotary Switch Knob

D. POWER SUPPLY UNIT*

Part No.	Description
101-2-0-1	A-C Power Supply (complete)
19-2-0-1	Power Transformer
19-6-0-1	Filter Choke
Std. 2654-31	Capacitor; 2 and 5 mfd
Std. 3246-178	Electron Tube; 6L6
Std. 3246-118	Electron Tube; 5U4
22-1-0-3	Electron Tube; 6SH7
Std. 3246-168	Electron Tube; 6SL7
22-4-0-1	Electron Tube; 5651
14-5-0-2	Fuse; 1.6 ampere
Cat. 7596	Willard Battery, 6 volt, 100 ampere-hour
069074	Battery Mounting Plate

E. LEADS

37-2-0-1	Polarizing Cell Electrodes to control panel
37-2-0-5	Power Supply Unit (101-2-0-1) to Electro-Chemograph
37-2-0-4	Storage Battery to Electro-Chemograph

F. WIRING DIAGRAMS

Drg. R-820-51, Sheet 2	Amplifier (R-820-51)
Drg. SSS-639-A-10	Recorder
Drg. L-D-2099-13-AB	Control Panel
Drg. B-D-2099-13-AE	Cable Connections between units
Drg. J-D-2099-13	Elementary Wiring of 62200
Drg. 101-2-0-1, Sheet 2	Power Supply Unit (101-2-0-1)

*Not part of Electro-Chemograph 62200

NOTE: For information on any parts not listed.....consult Philadelphia.

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